Delays Caused by Project Consultants and Designers in Construction Projects

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***Abstract*—Construction projects in Gulf rejoin presents particular conditions in which the consultant of the project has to concentrate during each phase of design to ensure that it will be accomplished on time, for example, the unrealistic of project duration, foreign designers and consultants, unusual growth of construction industry, the exceptional features of architectural details in the design of projects, and international consultant establishments, firms and office. This paper investigates the main causes of the delays contributed by the projects designers and consultants by representing their roles and responsibilities to hand over the projects on time. The outcome and the results of the study is prepared based on the designed questionnaires and interviews conducted with many consultants and designers intended to identify the causes of delays projects in Gulf region from the viewpoint of the designers. In addition, the required preventive actions of the designers are studied to avoid any impacts on the progress of the project. The study investigates other factors from the client side, contractor side and the appointed project manager might affect the consultant performance on the project.**

***Index Terms*—design process, roles and responsibility-ties, construction methodology, causes of delay, architects and designers**

I. Background

The participation of foreign consultants during the fast growth of construction industry in the Gulf States led to have an enormous impact on the construction industry in the region for the clients, consultants and contractors. Many consultants have become involved in protected contractual disputes and claims, with projects exceeding budget and time targets. Factors that contribute to project delays have been identified by many researches, e.g. the lack of designer's experience of identifying the project technical design specifications which should complies with the project and client requirements. "Reference [1]" studied the causes of delay in large building projects in Saudi Arabia and identified material related delays as the main cause of project delay. "Reference [2]" stated that a project may be delayed as a result of the direct action of major parties or of their failure to act especially if they have a duty to act. "Reference [3]" identified the sources of delays caused by the Client, the Consultants, the Contractors and Sub-Contractors and those which are not caused by these parties to the design and construction process. Delays are the most common and costly problems encountered on construction projects. "Reference [4]" looked into the causes of delays and cost overruns in public high ways and building projects and found that there was very good arrangement between the professionals surveyed on those factors that could cause delay and cost overrun. Early recognition, classification, and identification of the effects of the design delays has become essential and important part of the designers tasks during the preparation of each design phase. Project stakeholders are still suffering from the impact of project delays in spite of the adopted applications, and techniques of design management, project management and different software's used by architects and designers. Project completion dates regularly become extended. There are many reasons why delays occur in projects where the answer might be due to design changes during construction, discrepancies in design documents, lack of experience of consultant in design management and lack of consultant resources. It is important to identify the cause of delays by the consultant to avoid any delay in handing over the project and reduce the numbers of revising the work schedule during design and construction "Reference [5]" stated that the main reasons for the project delays are the changes of the contract document, inadequate supervision, late agreement with the Sub-Contractors and insufficient labor. This might be reflecting on the contractor performance which makes as in [6] saying that the main cause of construction delays is the project material, labor, equipment and financial factors which has not been estimated during the design. Determining, recognizing and identifying the various causes of the delay during the design and the construction are the responsibility of the consultant engineer to avoid any delay in the project time. The experts of construction design management should investigate deeper to find new techniques and implications to avoid delay.

II. Research Aims and Objectives

The study is mainly focused on the role and responsibility of the Consultants and architect resident engineer in reducing delay on major projects in the rejoin. The study aims to determine the main causes of delay in major infra-structures and building projects in Dubai and other gulf countries and to classify them in terms of the

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impacts on the final project completion date. In addition, it aims to identify the reason of the delay and its source. A project can be considered to be the achievement of a specific objectives, which involves a series of activities and tasks which consume resources, the consultant engineer should understand the objectives and he must give the maximum efforts of his roles and responsibilities which is a part of his duties to achieve the activities of the design work without delay. There are of course, factors other than varied work that may delay the project, and it is also generally recognized that delays may be attributed to the Client, to the Contractor or to neither party. The Information of this topic was collected from different sources such as literature review, questionnaire survey and interviews about design management, construction process, the type and causes of the delay by consultant and responsibilities of the resident engineer on the site for getting the feedback from the respondents to determine the major delay causes by the architect and the consultant. Questionnaire survey and interviews study findings has been used as a sign to the existing condition and measures that resident engineer of consultant can take to mitigate the determined factors of project delays.

III. Cultural Factors

Irregular meetings are usually conducted between the client and the architects during the design and conceptual development where many options and proposals are demonstrated and discussed during this phase. An ultimate delay will be caused from the argument and indirect disagreement between both of them. It occurs due to the lack of communications and the inability of understanding the project objectives between the two parties. The cultural differences between foreign consultants and the clients of the projects is a common problem due to the differences in religions, habits, traditions. etc.

Human interaction, such as the motivating factor of individuals, human behavior, organizational behavior, culture etc, what makes construction contract problem different is the unique nature of the project. In trying to understand why delays occur in designs of projects, it is important to realize that the whole process involves the interaction between parties with different primary objectives. The fast growth of the construction industry in gulf rejoin, has led to many international consultancy firms and Design Offices established. Some preferred to have their own design managers because they are fully familiar in the company roles, policy and procedures. This means that the managers increasingly have to deal with individuals from other cultures and should develop their interactive skills to tackle such problems. "Reference [7]" stated that the most suitable definition of culture could be introduced as the entire heritage of a society transmitted by word, literature. It includes all traditions, habits, religion and language. The Foreign consultant design manager and resident engineers do not have same way of thinking but both have the same target which is completing and handing over the project on time. Due to the different cultural backgrounds, they have different behavior, belief, attitude and values, which reflect how they run the project either during design or construction. The architects, design managers and resident engineers should know how to arrange and to deal with individuals such as the Client, their representative's, local authorities and the other stakeholders who are coming from different cultures. He must also understand and develop the communication skills, leadership skills, interpersonal skills, flexibility and the technological skills to overcome all the problems. "Reference [8]" confirmed that a very large range of parties involved in construction projects should be properly controlled.

IV. Work Environment in Gulf Region

Conventional method is the most implemented common and familiar method in the gulf region countries where client, consultant and contractor are the key players in the project. This method involves the disjointing of construction activities from design management. The consultant office is the main party who is responsible about the design, specifications and tendering process. The main contractor is appointed to implement and build what has been designed and specified. The essential feature of conventional Procurement is that the Contractor should produce what has been precisely specified in the documents. Designers and consultants acting on behalf of the Client in producing the contract documents which are the drawings, bill of quantities, technical specifications, and conditions and particular contracts. The Contractor is invited to fill the price of the complete set of documents that describes the project. Such documentation demands that the architects and the design manager should co-ordinates the design details from a wide variety of specialists. The result is that the Contractor has no responsibility for design. The contractor's offer of price is based on costs and rates entered in the Bill of Quantities, a document that itemizes and quantifies, as far as possible, every aspect of the work. The bill forms not only the pricing document but also, because of its comprehensiveness of all financial projects manners, it is an effective and important mechanism of controlling the cost of the project. Failure of design manager from the consultant side in identifying, describing, quantifying and specifying the working elements of the project precisely will cause a major delay in the project. The delayed projects typically produce financial penalties due to the failure of the achieving the construction project goals.

The accountability and liability for most project delays is frequently attributed to the consultant and contractor. Some delays could be better controlled or probably avoided by the consultant if they manage the design process in a very professional manner. The nature of the design and the unique architectural features of the project attributes sometimes to the delay of the project, that's why [9] stated that, the concluded other normal factors of the project delays are the design project complexity, quality level required of specifications, type and style of management, overall organizational structure, types of

contract and communication of design manager with his staff, main consultant and client. In conventional contracts, the Contractor's responsibility is to build the project according to the contract documents within the required cost and time budgets and the specified standards. The execution of the contract is administrated by the resident engineer and by the contractor's project manager who should have the experienced team, qualified resources and committed domestic subcontractors. The consultant or the resident engineers should be familiar in all types of communications process to monitor and control the work progress for the purpose of avoiding any delay in handing over the projects on time. Submittal and approval process of the project materials and specifications requires a regular coordination and double efforts by the consultant to expedite purchasing process. "Reference [10]" confirmed that other causes of delay are attributed to improper management of materials and hampered by lack of explicit and detail model of project materials management process. In conventional procurement approach, the resident engineer of the consultant office is the person who has the overall responsibility reviewing drawing, bill of quantities, conditions of contracts and the construction methodology of the contractor. The site supervision activity is one of the important responsibilities of the resident engineer and any lack of experience of the mentioned responsibilities might cause major contractual conflicts with the contractor which will cause big major delay in the project. Efficiency and performance of the Contractor's should be monitored by the consultant office to make sure the work progress of the project is in within the approved schedule. "Reference [11]" stated that due to the lack of experience in contract terminologies and wrong interpretation of contract terms by both the consultant engineer and the contractor project manager and due to the lack of information's in the condition of contract of traditional type, the project will never completed and handed over on time. The resident engineer is the person who gives the approval for the contractor's detailed working program which should be submitted within a specific period of time from the date of signing the contract.

V. Common Factors of Delays Caused by Consultancy Office

According to the literature review and other resources who confirmed that incomplete drawings and discrepancies of contract documents are major factors cause the delay. The majority of delays can be traced to inconsistent or to incomplete detailing of drawings, incorrect dimensions of walls and openings, inadequate detailing of difficult locations and inconsistent detailing. Many contracts were bid on the basis of incomplete information, require extensive changes during construction. Edwin H. 2005 stated that the design responsibility is transferred from the owner organization to the Consultant who is responsible for the design management in the Project and to be delivered by the design procedure system. "Reference [12]" stated that lack of information about the type of contracts, the conditions of contracts, major design issues, standard specifications and major design criteria to managers and engineers who works in consultant offices are one of the major problems that construction industry sector in gulf region is still suffering and generates many problems during the execution. Many problems occur in schematic and detailed design where conflicts between structural and services drawings becomes the norm. This creates difficulties in getting the approval of the final detailed design and other tender documents from state authorities. Another major factor of delays caused by the Consultant is the inability of effectively managing and preparing the contract document including bill of quantities and the approved drawings which creates a large margin of errors and omission in quantities. Poor appreciation of the design management process is another factor that causes delay by the Consultant. Inspection process during the work operations, the approval process duration of submittals and approvals of project materials and the technical site experience of the inspector who gets the instruction from the Consultant resident engineer are also factors attributes the project delay.

VI. Phases of Project Design

Projects designer are not finalizing the design without completing accurate comprehensive documents prepared by specialists through the phases of process and procedures due to the complexity of the required information. These phases interact with each other in a way to guarantee that the design match the client's requirements as well as being constructible. Briefing, feasibility, outlines proposal, scheme design, detailed design, contract preparation, construction and commissioning are the common design phases. The resident engineer of the project should be familiar with these phases so he can argue, discuss and communicate with all project participants mainly the project contractor. "Reference [13]" has confirmed that gulf region countries focuses on the development of construction industries by applying all factors of design and project management which always affecting positively on project completion with a very minor delays. "Reference [14]" stated that The Client may become frustrated with the low qualification of some of the design firms due to the limited interaction between the Client and the Consultant during the design phase of the project. This may cause a major delay to the project completion date. The Consultant should be fully aware of his duties to avoid any problem which may affect the design process.

VII. Design of Questionnaires Survey and Data Collection

The survey of questionnaire was conducted and prepared to evaluate the perceptions of the consultant resident engineers to the relative importance of the causes of project delays. The questionnaire survey objectives are to determine how much consultant participates in the factors of project delays. The survey was designed based

on 13 well recognized causes of delay which were obtained through an extensive literature review. Participants were requested to point out the level of importance of each cause. The causes were classified into three major groups: Client group relating to payments, interference, and slow decision. Consultant group relating to factors include design management, site supervision, and approval process. Contractors group relating to factors include construction methodology, site management, and improper scheduling and planning, during construction. Questionnaires were sent to architects, resident engineers, design manager and site engineer's who have a very good experience in construction projects. Respondents were requested to state their opinion of each delay factor on a percentage wise; the maximum percentage represents the maximum severity of delay. The weighting scale classifications used in the research survey results are as shown in Table I.

TABLE I. WEIGHTING SCALES IN THE RESEARCH STUDY

	Scale Description	Rank	Scale	Delay
1	Direct affect	5	100	Major
2	Always affect	4	85	Normal
3	Often affect	3	65	Delay
4	Slightly affect	2	45	Minor
5	Maybe ignore	1	25	Minor
6	Ignored	0	0	No delay

Thirteen theoretical cause of delay identified and formulated, contributed by the consultant as shown in Table II.

TABLE II. IDENTIFIED DELAYS FACTORS CONTRIBUTED BY CONSULTANT

Consultant office and resident engineer factors causing the delay	1	Discrepancies of contract documents
	2	Incomplete design drawings
	3	Level of design management
	4	Response to the inquiry
	5	Approval of Drawings for construction
	6	Inspection procedure process
	7	Technical and Managerial of technical resident engineer
	8	Approval process
	9	Internal and External process of communication
	10	Quality assurance and quality control
	11	Irregular changes in drawings and specifications
	12	Technical site staff on site full time
	13	Staff availability on sites

Looking to the questionnaires results and the feedback of those who were interviewed, it is found that their opinions showed great similarity. They suffer from the discrepancies of the design documents, incomplete design drawings, level of design management and the lack of the resources of the design and inspectors. These are some of common problems attributed by the consultant causing the delay to the project. In addition to these problems there are many problems still participates to the project delay and has to be considered by the consultancy firm and the resident engineer. Table III shows the Rankings for delays caused by the consultant as per the result survey and analysis.

TABLE III. RANKING FOR CAUSES OF DELAY BY THE CONSULTANT

Cause of Delay (See Table 2	Respondent Rating	Severity Rating 00	Highest and Lowest
1	67%	3.35	2
2	74%	3.7	1
3	63%	3.15	5
4	64%	3.20	4
5	67%	3.35	2
6	65%	3.25	3
7	41%	2.15	6
8	74%	3.7	1
9	64%	3.20	4
10	47%	2.25	6
11	63%	3.15	5
12	67%	3.35	2
13	63%	3.15	5

VIII. ANALYSIS OF MAJOR CATEGORIES OF DELAYS CAUSED BY RESIDENT ENGINEER AND CONSULTANCY OFFICE

Table I identify the severity scale of the results in percentage wise where severity value is considered based on the assumption of assigning the first highest percentage as the highest value, the second highest as to next highest and so on. Value of 5 is considered as 100% severity, value of 4 is considered as 85%, value of 3 is considered as 65% value of 2 is considered as 45% and value of 1 is considered as 25% of severity.

The second column of Table III showing the average response rating entered by the respondent's based on their experience on the severity of impact of each tabulated "identified" delay causes factor of Table I. This is expressed as a percentage, e.g. a 74% is the highest means this factor "always causes delay" which are the incomplete of the design drawings and the approval process of the materials and shop drawings and the second factors of delay. The rates of the second highest factors are 67% which are the discrepancies of contract documents, availability of the technical supervisor's staff on the site and the submission methodology.

The average of the severity causes by the Consultant office and the resident engineer ranging from 74% to 41% percentage wise. In ranking order the percentage could be considered ranging from 5 to 0, where 5 is highest and 0 is the lowest. The highest ranking is of 3.7 and the lowest is of 2.15 as shown in Table III. Factor no.7 is the lowest factor of cause of delay might be cause by the consultant which is the technical experience of resident engineer.

The second lowest factor of cause of delay is the internal and external process of communication as shown in Table III.

IX. Conclusion

The project architects, designers, consultants and resident engineers should be fully aware of the requirements by translating project objectives into drawings and specifications and cost analysis to make sure that the project will be completed and handed over to the client on time. "Reference [15]" stated that the resident engineer approves the appointment of Project Manager of the Main Contractor who shall select the Sub-Contractor on the basis of their ability to meet the contract requirement through a certain process. Written and verbal communications is one of important tools that resident engineer should know how to practice during construction which made [16] state that a lot of questions relates to the work progress (technical, legal, contractual and financial side) must be raised and discussed by all participants during the project progress meetings to avoid conflicts. The following actions should be considered and taken care by the consultancy office through the resident engineer to eliminate and avoid the factors attributes to project delay caused by the consultant of the project during the life cycle of the project:-

The design manager and resident engineer should make sure that their team members are applying all techniques and implications of design management process during design phases and construction phase. The resident engineer should have contractual, technical and financial experience in construction projects. The consultancy firm must appoint an The experienced and qualified design manager to coordinate and communicate with project design team and other project stakeholder especially the client and the architect to make sure that project objectives are very clear and can be achieved as per the client requirements. Full awareness of design manager who deals directly with the client should be familiar in cultural issues to manage and control the required changes and modifications of client during design development phase and during executions well. Consultant should also advise the Client about the general cost and time implications resulting from changes during the design requested by the Client. Design manager should invite all nominated Sub-Contractors during the tendering phase to response, discuss and clarify all technical issues relating to the assigned items that will do and making sure and client's requirements and project objectives are very clear. Design manager and resident engineer must check the contract documents to eliminate all discrepancies before inviting tenders for biddings the projects. Consultancy firm should confirm in writing the difficulties of the execution of the problematic items in design and tender documents to minimize the technical inquire which might be raised by the contractor during the execution. The resident engineer should make sure that the contractor construction methodology is submitted at very early stage from the date of signing the contract for early approval process to avoid any problem during execution.

X. Recommendation

Producing a realistic project duration projection, procurement strategy and controlling the design process requires full collaboration and co-ordination between the design manger and the rest of project team during design which also identifies deficiencies that are likely to improve both design and subsequent construction.

Consultancy firms must spare provisional amounts or specific budgets for continuing education and professional training to their design managers and supervisory team specially the resident engineers to increase level of their contractual and technical experience. Engineering project management, design management, conditions of contracts, value engineering and construction management are some of the important courses that they should be trained in. It is essential for the resident engineer to spend more time on studying design criteria and review each step with the client so as to gain approval before progressing to the next phase for avoiding any changes that may affect the project time and cost. To reduce the possible conflicts and disputes that may occur during construction the design should also be coordinated before releasing the tender documents for bidding and construction. It is also recommended that the design manager should clearly understand the project objectives so that he can plan the required resources. This is to help in finalizing the budget of both design and supervision staff. Resident engineer should be fully aware of the procedures and techniques of the project management. He should have technical and managerial knowledge of design and construction, especially method of analysing the submitted working program of the contractor and determining the critical work activities of the project Reading, understanding and verifying general conditions of the contracts and particular conditions along with drawings, specifications and Bill of Quantities in details is a part of the responsibilities of resident engineer to help him mitigating any potential delay.

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